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BRISBANE

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Edited by

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The

Cane Growers' Quarterly —Bulletin—

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Review of 1950 Report of Director of Sugar Experiment Stations.

The 1950 Annual Report of the Bureau of Sugar Experiment Stations was tabled in Parliament on 23rd November, 1950. For the convenience of cane growers, the following abstracts have been prepared; these present the major features of the Report, and particularly those of interest to the cane farmer.

GENERAL.

The growing season for the 1950 crop may be described as one of abnormally high rainfall, combined with a deficiency of sunshine in all areas. The net effect of the conditions varied from district to district. Heavy flooding occurred in parts of the northern areas but no serious damage to crops resulted. The continuation of the wet season beyond its normal period prevented land preparation and planting in all areas, and fields which were planted between rains became waterlogged and gave poor resultant stands. In consequence planting for the 1951 harvest will be delayed until the spring. The climatic conditions of the early summer period and of the following wet season were favourable to the development of very high grub populations in north Queensland and most areas not protected by benzene hexachloride were seriously damaged in the autumn months. However, the 20,000 acres treated with this insecticide were unaffected by this serious cane pest and as a result the production of these lands was greatly increased. In no instance was there a break-down of the control.

Another effect of the universally prolonged wet season was the heavy arrowing experienced in all centres. This naturally affected late growth in districts where temperatures were favourable to winter development and it also made impracticable the standing over of many crops which were otherwise suitable.

The most serious effect of the late rains was the postponement of early crushing dates. Almost every mill was compelled by lack of cane supply to close down for some weeks or to start much later than originally planned. It is not feasible to extend the season to make up for this lost time since the next wet season and the difficulty of retaining labour after the end of December will force the closure of mills before all cane has been harvested.

The late plantings for the 1951 crop will undoubtedly have an effect on the tonnage produced for that year. In the Mackay area in particular practically no early planting was carried out, and from Townsville north the proportion of early planting was considerably below normal.

The supply position showed some improvement over the previous year particularly in regard to fertilizers and

tractors, but the serious steel shortage continued and there was no amelioration of the time lag in obtaining such items as mill machinery, tramlines, agricultural implements, &c.

1949 CROP STATISTICS.

For the second year in succession a record was established for tonnage of cane crushed at the State's 32 factories. The final figure reached 6,518,021 tons of cane, being 84,465 in excess of the 1948 crop. Although higher crushing rates prevailed in general, the season was unduly extended in many cases to enable handling of the large tonnages involved. Crushing began on May 25th at Macknade and Inkerman mills and a week later Babinda, Tully and Victoria started the season's work. By the end of June nine other mills were in operation and the remainder followed during July. At the other end of the season Hambledon Mill was the first to finish on November 18th, but six factories extended operations into January, 1950, the last to complete work being Isis and Racecourse on the 12th and 13th respectively. The longest season was 32.3 weeks at Macknade, but Victoria and Inkerman also experienced crushings in excess of 31 weeks.

The amount of condemned cane delivered to the mill amounted to 4,394 tons. This unusually high tonnage of cane below 7.0 c.c.s. was due, in the main, to the effects of red rot disease at the end of the season in Mackay.

The tonnage of sugar produced during the 1949 season, including 1,031 tons local sales, amounted to 897,267 of 94 net titre. This was below 1949 production by 12,782 tons but was in excess of the 1939 yield. The extra cane crushed was more than offset by the lower quality ratio of 7.23 which is one of the worst figures recorded in the last twenty years. In the past eleven years the ratio has exceeded 7.0 on six occasions, and of the five years when it was below 7.0 the best recorded figure was 6.77 in 1939.

In Table I. will be found the district figures for cane and sugar per acre. In the aggregate the yields are slightly below those of 1948 the cane being 1.21 tons lighter and the sugar 0.26 tons per acre less. The Lower Burdekin area topped the State for unit production with 31.74 tons of cane and 4.67 tons of sugar per acre. These were appreciably below 1948 figures as are also the yields of three other districts. On the other hand the Mackay, Childers-Maryborough and Nambour-Beenleigh districts showed an improvement. The yields of the last-mentioned district were particularly good even though due cognisance is taken of a proportion of standover cane. Actually in the Nambour-Beenleigh area only 821 acres were two-year cane representing 14 per cent. of the area harvested.

TABLE I.

TOTALS AND AVERAGE YIELDS BY DISTRICTS: 1949.

(Domestic Crushing).

Districts.	Tons of Cane.	Tons Cane per Acre.	Tons 94 N.T. Sugar per Acre.
Mossman-Ingham	2,426,929	23·29	3·31
Lower Burdekin	881,262	31·74	4·67
Proserpine	226,012	18·35	2·63
Mackay	1,584,069	21·05	2·84
Bundaberg-Gin Gin	850,739	24·61	3·09
Childers-Maryborough	376,740	24·41	3·09
Nambour-Beenleigh	172,270	29·87	3·71
	6,518,021	23·67	3·26

SUGAR VALUES, 1949 SEASON.

The Sugar Board has declared the final price for the 1949 season's sugar as follows:—

—	No. 1 Pool.			No. 2 Pool.	Total.
	Home Consumption.	Surplus.	Total.	Excess.	
Tons	464,982	344,743	809,725	86,511	896,236
Per cent.	57·4247	42·5753	100	..	..
Price	£24 6 0	£29 7 6	£26 9 3	..	£26 14 10

In addition, the values for New South Wales production were:—

—	Home Consumption.	Surplus.	Total.
Tons	32,320	8,381	40,701
Per cent.	79·4076	20·5924	100
Price	£24 6 0	£29 7 6	£25 6 11

The total value of the Queensland crop, calculated from the above figures, was approximately £24,000,000, being an advance of £800,000 on the previous year. This was due to the rise in overseas price from £28 2s. to £29 7s. 6d. per ton. The average overall price was 24s. 11d. higher than in 1948 and this more than offset the lower sugar yield.

REVIEW OF THE INDUSTRY.

Sugar Agreement.

In the last Annual Report it was stated that during September, 1948, the British Ministry for Food announced the five-year guarantee for sugar producers in this country to cover the years 1948 to 1952; this contract covered all exportable surpluses. In November, 1949, a conference was convened in London at which all sugar-producing countries of the British Commonwealth were represented. In December of the same year agreement was reached between the British Government and the Australian delegation covering future markets and certain aspects of price. It was agreed that in 1950 the Australian export price would be the same as for the Colonies, representing a probable advance on 1949. It was also agreed that from 1953 to 1957 a market would be found for a total exportable surplus of 600,000 tons per annum. Of this amount the United Kingdom undertook to accept 300,000 tons at a guaranteed price although this would be fixed by negotiation from year to year. The other 300,000 tons would be sold on the Canadian and United Kingdom markets at world price plus preference.

Since the 1948 agreement provided for a guaranteed price for all exportable surplus sugar from 1948 to 1952, and the new agreement covered up to 600,000 from 1953 to 1957, Australia is provided with an assured export outlet for up to 600,000 tons for the next eight years. Provision was made to extend the term if found mutually desirable.

This news was welcomed by the industry and it was considered that a determined effort should be made to produce the extra sugar required by 1953. The Central Cane Prices Board accordingly increased the aggregate mill peaks to a proposed ultimate figure of 1,045,000 tons of 94 net titre sugar, this target being conditional upon (1) three per cent. soldier settlement being realised,

(2) new settlement, (3) improved settlement for smaller assignment holders and (4) provision of adequate mill crushing capacity.

Most mills in the State have, as a result of this expansion policy, planned extensive additions and improvements to plant to cope with the extra tonnage of cane they will be called upon to treat.

Royal Commission.

Almost simultaneous with the Government's decision to approve the new mill peaks an announcement was made regarding the appointment of a Royal Commission to enquire into the practicability and expediency of establishing additional sugar mills in Queensland and to plan the proper development of the industry over the next twenty-five years. The plans outlined in the foregoing section provide for the extra sugar required for the export market but it was appreciated that the future of the industry required close examination so that the increasing home consumption market would be cared for. Over the past ten years Australian requirements have increased from 360,000 to 469,000 tons, or an annual increase of nearly 12,000 tons of sugar. Although this increase may be somewhat misleading owing to the buoyant export market for jams and such products it is a pointer to the fact that the local market is steadily expanding with increasing population. Within another twenty years it is possible that a further 120,000 tons of sugar will be required and orderly planning is essential to ensure that any future home requirements are met without interfering with any export commitments.

Increased Sugar Prices.

In December, 1947, the Commonwealth Government agreed to an increase of £4 13s. 4d. per ton in the wholesale price of refined sugar and this resulted in the retail price rising from 4d. to 4½d. per lb. Owing to rising costs in the way of freights, coal, jute and wages the industry received only £1 15s. of the £4 13s. 4d. on the 1948 output and the prospects for the 1949 sugar yield looked even less bright with the continuation of rising costs on every hand.

Accordingly, in July, 1949, the sugar organizations prepared a case for review of the Commonwealth Sugar Agreement including a request for a further increase in the price per ton of refined sugar from £37 6s. 8d. to £41 9s. 4d. This would have the effect of a further ½d. per lb. rise in the retail price. The industry's case was endorsed by the Queensland Government and by September the Federal Cabinet decided in favour of the increase sought. A Bill to approve the amendment passed both Houses of the Commonwealth Parliament and was assented to on October 28th. The new price operated on approximately two-thirds of the 1949-1950 sales year and the raw sugar price resulting from home consumption sales advanced for the 1949 season, to £24 6s.

This is the highest price received since 1931, and the average export price of £29 7s. 6d. is the highest ever received. The average return for all sugar—home market and export—was £26 14s. 10d., an advance of £1 4s. 11d. on the previous year.

Costs.

On the other side of the ledger must be entered the steeply rising cost of production caused by the upward trend of nearly all requirements in field and mill. The basic wage has increased considerably and this has been accompained by proportional increases in cane cutting rates and in the wages of mill hands. The effect of wage increases in other industries is reflected in the rising prices of tractors, implements, fuel, repairs, mill machinery and fertilizers. The major portion of the increase in price of refined sugar has been absorbed by higher costs in refining and distribution and little margin remains to offset the spiralling cost of production on farms and in mills. The favourable overseas price is the one factor at present operating which enables the industry to maintain a reasonable economy.

Manpower.

The improvement in the field labour position mentioned last year continued during the period under review. During the height of the season the effective units reached 8,000, of which professional cutters numbered 6,290. Immigrants contributed 768 to the total and farmers and cutters totalled 957 at one stage of the harvest. The position cannot yet be considered as highly satisfactory since labour shortages do exist in certain districts. The expansion of mill capacities will demand a larger labour pool in future years if the mills are to be kept fully supplied with cane.

Labour for field work other than cutting has been short in all districts and mill labour has barely sufficed to maintain continuity of operations. Both sides of the industry have suffered from the number of transients who move from area to area as the season proceeds.

Fertilizer.

The supply position during the year approached more closely to normal than at any time since the outbreak of war. Superphosphate and potash were in good supply and were sufficient to fulfil all needs. Sulphate of ammonia, although not adequate to satisfy all orders was not seriously deficient but organic fertilizers such as meatworks' bone and dried blood showed no improvement. The sulphate of ammonia position for 1950 season is much improved and adequate supplies are assured. As from 1st July, 1950, sharp price increases operated, potash rising by £3 10s. per ton, sulphate of ammonia by £4 and superphosphate by £2 5s. The last-mentioned item was due to the abolition of the Commonwealth subsidy on this particular fertilizer. The £500,000 subsidy on sulphate of ammonia continues unchanged.

During the past twelve years fertilizer prices have increased more steeply than many other commodities. Sulphate of ammonia has risen 257 per cent. to £30 17s. 6d., but is subsidised to the extent of £4 per ton; potash has increased by 253 per cent. to £34 8s. per ton, and superphosphate by 183 per cent. to £9 15s.

WORK OF THE BUREAU.

During the year the field activities of the Bureau covered all of the routine investigational work normally performed, as well as certain new studies designed to effect improvements in disease and pest control, soil conditions, fertilizer and lime applications and minor element deficiencies. The work in certain areas was somewhat disorganised by staff movements consequent upon the loss of two Advisers but the replacement officers have carried out the field programme effectively.

Fertilizer trials were harvested at Mossman, Fishery Falls, Moresby, Proserpine, Bundaberg and Yandina. Simultaneously, fertility surveys were conducted on areas of the same soil types to ensure a better understanding of problem areas and to define improved fertilizer practices on those properties. Combined laboratory and field studies on soil acidity, responses to lime applications and correlations with calcium and magnesium contents of soils suggest that a new approach to this work is desirable. The conception of calcium deficiency as related to plant growth appears to be a more promising line of investigation than the traditional theory of soil acidity which was corrected by relatively heavy lime applications.

Minor element studies were carried out on a block of cane in the Mackay area which exhibited pronounced deficiency of some essential plant food. An excellent response was obtained to a dressing of 55 lb. per acre of copper sulphate thus marking the first clear-cut response to a minor element in the sugar industry of the State. Confirmatory trials are in progress. Several other trials in the high rainfall belt on gravelly and leached soils failed to give any observable responses and it can only be assumed that deficiencies have not yet developed on any of the soils investigated.

The trend towards potash depletion became more marked since last year while the phosphate status of the hundreds of

soils examined was hardly changed. This effect is doubtless a result of the high cost of potassic fertilizers, but the trend is a dangerous one in view of the necessity to maintain correct plant food balance. A considered fertilizer recommendation is sent to all growers who submit soil samples but, naturally, the advisory service can go no further than making the recommendation. The implementation of the advice is the responsibility of the grower.

The work on improvement of soil structure by means of sugar containing amendments advanced a step further during the year. The laboratory studies with molasses continued as well as with certain sweet sorghums. The results of a subsequent field trial with the same substances showed a marked and sustained effect on aggregation. The final value of such applications will best be measured on certain intractable soils where poor structure impedes drainage and cultivation.

The progress results with weedicides is discussed in detail elsewhere in this report. Although control is not complete under all soil conditions the experience is in line with that in other countries where it is found that the characteristics of particular soils are the principal factors to be considered in weedicide usage. However, the outstanding results at Bundaberg and to a lesser extent at Meringa are sufficient to indicate that on certain soil types at least the pre-emergence control of weeds and grasses is not only practicable but economically sound.

In the entomological field benzene hexachloride attained still greater success as a crop-protection insecticide. Very heavy greyback grub populations developed in 1949 and it is certain that in the absence of an effective control measure the losses would have been even more disastrous than in 1934. Twenty thousand acres were treated with benzene hexachloride with complete success where the recommended method of application was adhered to. On untreated areas where grub infestations occurred the damage to cane was so heavy as to cause collapse of crops.

The outstanding success of this insecticide has not been accepted by Bureau entomologists as a reason for complacency or as a final answer to the grub problem. Although it was a happy coincidence that the major grub pest should have been so sensitive to B.H.C., the other grubs—Frenchi, Trichosterna and the Childers grub—appear to be more resistant to the normal applications and research continues on the optimum dosage and method of application. In addition any new insecticidal discovery is tested for its efficiency in controlling any of our pests. At the moment six newer insecticides are undergoing field trials against the various grub species.

It has for years been a subject for conjecture by entomologists and agronomists as to what losses, if any, were caused by soil-inhabiting insects of the minor pest class. The serious damage occasioned by the "major" pests suggests that any insect feeding on roots or stubble is causing some crop loss, even if insignificant. The availability of such a good insecticide as B.H.C. makes it practicable to carry out experiments along these lines. Although all soil insects are not sensitive to the insecticide it should be possible to measure with some degree of precision the damage which the susceptible ones are doing to our cane crops.

Pathological investigations during the year were focused principally on ratoon stunting disease although the usual control problems associated with Fiji and downy mildew diseases were not relaxed. In addition an extensive outbreak of yellow spot disease and a build-up of eye spot necessitated certain investigations on these diseases.

Progress with the studies on ratoon stunting disease were necessarily slow but satisfactory progress was made with control in the field. The legislative action to control planting material has given good results and there is cause for optimism that a clean-up may be achieved without recourse to eliminating the valuable variety Q.28. A large annual programme of investigational plantings includes a ratoon stunting varietal resistance trial, and before long the resistance or susceptibility of all major varieties in the State

will be known. In addition a check is kept on the susceptibility of all new seedling varieties of promise. The causative organism is not yet known but all indications point to a virus. The serological tests, although not clear cut, appeared to confirm the virus theory.

The occurrence of yellow spot provided an interesting problem because of its widespread occurrence in many districts. Although not officially recorded in Queensland previously, there is some evidence that this was not a first appearance. Either unusual seasonal conditions obtaining in the first half of this year or the development of a virulent strain of the organism could be the cause of the outbreak.

Perhaps the most pleasing news on the pathology front is the fact that only seven stools of cane affected by downy mildew were located during the twelve months—and these in one two-acre block of old ratoons at Bundaberg. No recurrence of the trouble was noted in the Hambledon area where last year's outbreak caused some concern. It may not be too much to hope that this disease—the worst in the State not many years ago—may now be under complete control. In five districts of Queensland, Mossman, Cairns, Lower Burdekin, Mackay, and Bundaberg, downy mildew has caused the removal from approved lists of major varieties or has prevented the addition of new ones, and Cane Pest and Disease Control Boards have expended large sums in its control. Its disappearance from the list of our cane diseases would make less difficult the release of promising but susceptible cane varieties.

Fiji disease although still on the wane, is still a cause for some concern. Last year's total of 4,449 stools was reduced to 1,679 in the year under review. This result is praise-worthy and reflects credit on the work of inspection gangs. P.O.J. 2878 should virtually disappear from Moreton fields during 1950 and this will be of major assistance in controlling this disease. However, the partial susceptibility of C.P.29/116 makes a clean-up in that variety a difficult proposition. A recurrence of Fiji disease was noted in Childers during the year where it had not been seen for nearly four years; the reason for this reappearance is thought to be a deserted farm on which volunteer diseased cane existed in the intervening period, and from which the disease spread to an adjacent irrigated farm.

Since the reorganization of the Bureau in 1928 and the creation of the pathology division disease resistance trials of various types have been carried out in several districts in the State. Their successful management has provided a problem of some magnitude because of the fact that they had to be located in isolation from commercial cane fields. The difficulty of finding farmers outside the closely farmed areas with the facilities to plant and care for the trials had to be experienced to be appreciated, and many failures due to neglect and to absence of irrigation in dry years necessitated repetition of work. To overcome these difficulties the Bureau has established a disease resistance substation at Moggill, near Brisbane, where all disease resistance trials will be carried out in future. The exception is ratoon stunting disease, which, for the time being will be located in Mackay until more is known of its transmission. There is no canegrowing district in the State in which the diseases Fiji, downy mildew, leaf scald, chlorotic streak, gumming and red rot all occur and it would be neither politic nor practicable to run such a substation in proximity to any cane area and thus create the risk of introducing a new disease to that district. It is a fortunate chance, therefore, that all of these trials can be safely carried out near Brisbane without the slightest risk to commercial plantings, while still within a relatively short distance from the Bureau laboratories.

On the Experiment Stations the usual routine connected with seedling raising and selection was carried out and this constituted the major portion of the work. In addition, the long-range cultural trials dealing with trash conservation, long fallowing, fertilizer plus crop residues, &c., were proceeded with. At the Lower Burdekin Station a start was made with seedling plantings and with a long-term trial to investigate the growing of first and second ratoon crops of a range of

varieties. During the current year this new station will make much larger plantings and will doubtless become an important unit of the Bureau.

The earlier investigations carried out on our stations in relation to legume crops suitable for the various districts have given speedy results. Demand for seed of velvet beans, Reeve's Selection cowpea and Cristaudo pea far exceeded supply, and the value of these three crops is being appreciated to a greater extent each year. The problem of seed shortage is a serious one despite the high prices offered and it would appear that a considerable improvement will have to eventuate in the seed supplying areas before the sugar industry's requirements are fulfilled.

The Mill Technology staff continued the 1948 investigations on vacuum pans and crystallizers and the results of the low grade massecuite studies will form the subject of a forthcoming Technical Communication. Certain aids to clarification were also the subject of enquiry and one of these, bentonite, will be under trial on a factory scale in the 1950 season.

The large expansion of generating plants in many Queensland mills has resulted in the engineering technologist being requested to design switchboards for suitable control of output. Complete designs and specifications were prepared for three factories. In addition aparatus was assembled for an investigation into the bagasse nuisance which is so troublesome in certain sugar mill towns.

The two outstanding changes in the varietal census of the State were the rise of Q.50 to a crushing of nearly 600,000 tons of cane and the displacement of Badila from its leading position by Trojan. The rapidly changing varietal picture causes some surprising changes almost annually and it is within the realms of possibility that Badila may return to the premier position in a year of different climatic conditions. C.P.29/116 rose to third place with the fall of Q.28. The decline of Co.290 to thirteenth place draws attention to the relatively short life of this once important cane variety. It is just fifteen years since it was first distributed. Queensland-bred varieties now total 59.2 per cent. of the crop and this figure is still rising.

An interesting feature of the cane breeding work is the production of promising canes with high early sugar and containing one-quarter and one-eighth robustum blood. Those with one-quarter robustum are rather hard-rinded but the more diluted crosses are attractive soft types. It would appear that the use of this New Guinea material promises to result in suitable commercial canes for Queensland.

The field staff in the various centres from Nambour to Gordonvale made possible further valuable advances in our knowledge during the year. A better understanding of the fertility status of our soils was one result and the performance of new and old varieties was measured by numerous trials with a view to greater precision in assessing relative values.

A Fertilizer Distributor Adaptation.

By N. McD. SMITH.

The adaptation of International Harvester Company star feed fertilizer distributors to Ferguson tractors is rapidly gaining popularity in the Moreton area. The method of attachment was first conceived by Mr. V. Suosaari, Bli Bli, who attached several sets of bins, purchased from War Disposals, to neighbouring tractors. As shown in the illustrations, the drive is from a land wheel which actuates the star feed per medium of bevel gears and a spindle. There is no throw-out controlling stoppage of the flow as the power lift in the "up" position raises the drive wheel off the ground. This is a distinct advantage as the tractor may be moved about from one spot to another in the field without wastage of fertilizer.

In third gear, on a farm of irregularly shaped fields, 12 acres were fertilized in eight hours. This work was completed by one man and does not include time taken to bring the fertilizer to the field from storage. The setup, as illustrated, cost £12 10s. complete, with all necessary fittings. The bins hold a half-bag of fertilizer each and are set low enough for easy filling. Advantages of the arrangement are:—

1. With low set bins, the risk of fine fertilizer blowing over the tractor is minimised.
2. The lifting of the land wheel into a locked position allows cultivation if so desired.
3. Four operations may be performed in one if necessary—viz., cultivate, fertilize, stir in fertilizer, and by fitting of a scratcher small weeds in the row may be controlled.
4. The fertilizer is placed on each side of the row close to the stool.

Fig. 43.—Showing one of the fertilizer hoppers mounted on the Ferguson tractor.

Fig. 44.—The fertilizer hoppers in the raised position. Note drive from land wheel.

The International Technologists Meet in Brisbane.

By C. G. HUGHES.

The Seventh Congress of the International Society of Sugar Cane Technologists received a good deal of publicity during the fortnight's tour of the major areas which preceded the Congress itself, and during the week of the Congress meetings. Overseas delegates and local members were unanimous in declaring that the papers presented were of great value to both the agricultural and milling branches of the sugar industry. It is not generally realised however that a Congress such as this, although primarily intended for the scientists engaged in the technology of sugar production, also yields much of interest and direct value to the farmers who produce the sugar cane, the basic material for the whole industry.

There were 84 papers presented at the Congress. Many were highly technical in nature and could only be appreciated by a handful of the delegates but others were of general interest to cane farmers and some had particular application to Queensland.

Practically a whole morning was devoted to a discussion of papers dealing with the use of benzene hexachloride in the control of white grubs in cane fields—a problem which is not confined to Queensland alone. Although local entomologists have been amongst the leaders in this work—it would actually be more correct to say they have been *the* leaders—the interchange of ideas with visiting entomologists and the discussion of mutual problems was very much appreciated and will undoubtedly help in solving some of the difficulties which still remain.

On the disease angle, several papers on red rot of sugar cane showed how serious the losses from this disease can be in various parts of the world. The further knowledge of the fungus causing the

Fig. 45.—The Hon. H. H. Collins (Minister for Agriculture and Stock), Dr. P. Honig, General Chairman, and Dr. J. W. Hes, Java, discuss sugar cane germination.

disease and its effects will help to solve the problem of the control of the disease in the temperate areas, where it is most serious. Delegates were very interested in a paper by D. R. L. Steindl of this Bureau on ratoon stunting disease, which is a trouble confined to central and southern Queensland. It has many puzzling features, the most interesting of which is the lack of the usual symptoms of disease. Its recognition as a transmissible disease, which was announced only in 1949, may help to solve many of the problems associated with the deterioration of varieties, now causing so much concern amongst cane breeders and agronomists. A symptomless disease could well be responsible for the necessity to change varieties at frequent intervals, which has become such a prominent feature of cane culture in most countries of the world in recent years. The actual subject of varietal deterioration was dealt with in a paper by N. J. King, Director of the Bureau, and it gave rise to a lively discussion. There was little positive information concerning the problem brought forth but the paper served a very useful purpose in setting out the problem in clear terms and indicating the lines along which it may be tackled.

The general papers on soils and fertilizers included one by L. G. Vallance and K. C. Leverington, which gave an idication as to the manner in which the structure of our soils may be prevented from deteriorating further and even may be improved. An experiment carried out near Brisbane was described and it was proved that the addition of molasses or residues of sweet sorghum would, through the stimulation to the growth of the soil fungi, lead to a marked improvement in the texture of the soil.

The routine fertilization of the cane crop in Queensland is reasonably well advanced but in some aspects and in the hands of some farmers it has to be admitted that it is likely to be somewhat of a hit-or-miss item in production and on occasions may not yield the best results. Control of the fertilizer application according to the needs of the growing crop was outlined in a lecture by Dr. Clements of Hawaii. He showed that it was profitable to measure, and maintain a close watch over, all possible factors contributing to the production of the crop. His methods were at the moment only applicable to cane growing on a large scale but the approach was sound and from it might come something of direct value to the comparatively small-scale Queensland producer. P. Halais of Mauritius was also interested in the fertilization of the growing crop and he described his proven methods whereby the laboratory analysis of leaf samples gave an accurate indication of the requirements of the cane in the field.

The use of the hormone-type weedicides is one of the recent promising developments in cane culture both in Queensland and in overseas countries. There were two papers on this subject presented to Congress. One from Louisiana described extensive experiments in the control of Johnson grass using hormones and other types of weed-killers but the results obtained were not satisfactory and this grass remains the chief weed worry in the Louisiana fields—a warning perhaps to any Queensland farmer who might be inclined to take this persistent, strongly growing grass too lightly. The other paper on weedicides came from Puerto Rico. It described the injury to sugar cane which could be caused by the hormone preparation, 2,4-D. It was found that a significant reduction in growth was caused by 2,4-D, when applied directly to the tops, especially at and around the spindle, in shoots two months of age. This may explain why cane carelessly sprayed with this chemical often does not attain normal development. The results offered, though suggesting more care in the use of the weedicide, were in no sense arguments against it for the control of weeds in the cane.

The workers interested in the breeding of new cane varieties had several papers to discuss. Some were academic, in that they were reports of fundamental research, some others were descriptions of the policies followed in various

countries and yet others gave valuable information as to the lines along which cane breeding should proceed in the future. There was no doubt that the present blending of the wild and noble canes is yielding excellent seedlings in many parts of the world but the fact remains that the demand for new canes is increasing and the cane-breeder must be continually on the look out for additions to his range of parents. In the case of Queensland, the alert watch has been extended into action and a Bureau expedition to New Guinea next year will, it is hoped, return with many valuable new breeding canes.

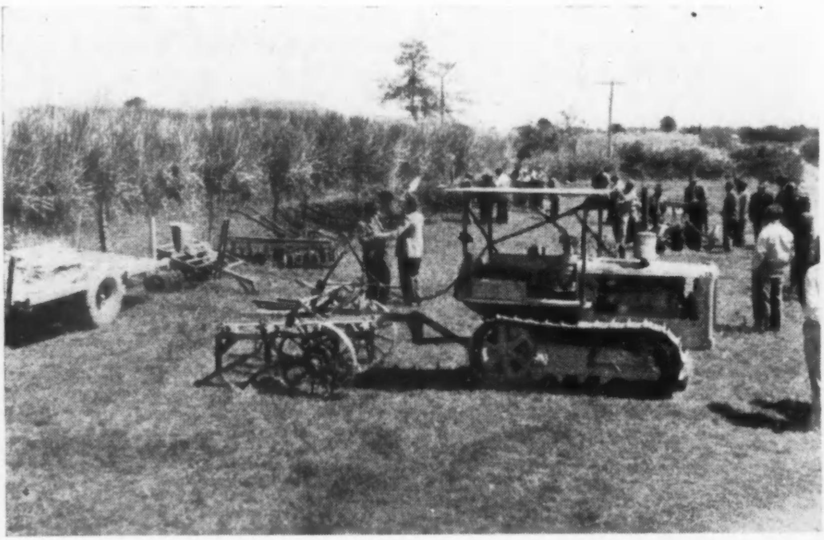

Fig. 46.—Visitors were particularly attracted by Queensland farm implements. Here is part of a display at a North Queensland farm.

A paper of particular importance to the whole of the tropical eastern coast of Queensland was presented to the Congress by Professor Owen Jones of the University of Queensland. It dealt with the early detection of hurricanes or "cyclones" as they are called in this State, by the use, not of standard meteorological methods of observation and plotting, nor of the modern radio-sounding and radar techniques, but of seismographs, which are instruments used to record the shakings of the earth's crust. Normally used for the location and measurements of earthquakes or major movements, they also record the minor shakings which are occurring all the time. A modification of the ordinary seismograph will record the shakings brought about by hurricanes when many hundreds of miles away and before they have developed their full intensity. These violent storms are notoriously unpredictable in the tortuous track they might pursue and in order to plot them accurately a group of seismographical stations is necessary. This has not yet been established in Queensland but even with the set-up available at present and even though the one instrument available was in Brisbane, the cyclone which devastated Carmila in March last year was clearly indicated three days before the Weather Bureau issued a cyclone warning. Professor Jones recommends the establishment of a number of stations along the Queensland coast, or on coastal islands, as a

valuable supplement to the methods of detection at present in use.

The majority of the 27 papers on the milling side of the sugar industry dealt with various aspects of factory operation but some were of general interest to the industry as a whole. Such papers included one on relative percentage payment, one on paper products from sugar cane and one of the deterioration of raw sugar. In the first, Mr. C. W. Waddell of the Cane Growers' Council outlined the history and set out the principles of that the simplest way to obtain the fibre would be by grinding the cane with abrasive stones and then separating the insoluble from the soluble constituents by a process of diffusion. The actual manufacture of the board or of corrugated paper could be most economically handled as a slack season activity at the sugar mills.

The paper on deterioration of raw sugar by two C.S.R. Co. workers, I. R. Sherwood and W. J. Hines, showed that much loss in sugar is due to moulds,

Fig. 47.—Delegates and local growers watch a mechanical loader at Ingham.

a relative percentage payment system, which is in operation at several sugar mills in Queensland, and, the author pointed out, could also be used for other primary products which were paid for on a quality basis at a central collecting point. The article on paper products from sugar cane by E. Antonio Vasquez, of Cuba, pointed out that the manufacture of fibre board will depend for its prevailing rate of expansion on the fibre of the sugar cane, either in the form of bagasse or in the form of mechanical pulp. The author suggests but the article is in the nature of a progress report and methods of preventing losses due to these fungi have not yet been worked out.

It is a proud honour that Queensland has been able to act as host for the International Congress on two occasions —no other country has yet done so— but the honour confers many obligations on the local members of the industry. They worked hard for the success of the Congress and generous thanks to the individuals and organizations concerned were given by the delegates before they

Fig. 48.—The Trembath "scratchers" were demonstrated at Bartle Frere. In these days of mechanisation the horses created as much interest as the implements.

left for their homes, but there still remains the arduous task of publishing the papers, the discussions and the general account of the Congress and the social activities. The volume will run to more than 1,300 pages but it is hoped to have it published in the present month.

Fig. 49.—Four loaders operating on Fairymead plantation created a deal of interest.

Yellow Spot Disease.

By C. G. HUGHES.

INTRODUCTION.

Towards the end of the 1950 wet season, many farmers in North Queensland noted that their fields, particularly of Trojan and Eros, were suffering from some disease instead of giving the usual appearance of ripening cane. Most of the green leaf tissue had been replaced by dying, yellowish-red blotches, often extending over the whole surface of every leaf in the stool. The cane remained alive but ceased to grow and the loss of cover lead to a prolific growth of autumn and winter weeds and in many cases a consequent difficulty in burning for harvest.

Inspections made in various parts of the Queensland cane belt revealed that the disease, which was identified as yellow spot, was practically confined to North Queensland. The only record of it south of Townsville was in experimental plantings near Beenleigh.

Yellow spot had not been recorded before in Queensland, although there is reason to believe that it had been present for a number of years and had remained unnoticed either because the varieties generally grown were resistant to it or because there had not been a season suitable for it to appear in epidemic form. It has been recorded in a number of other countries besides Queensland and a recent publication reports it as present in Argentina, Barbados, Brazil, British Guiana, China, Colombia, Cuba, India, Indo-China, Java, New Guinea, Okinawa, Philippines, Reunion, Taiwan, Trinidad and Tobago and South Africa. In the British West Indies it has been known for nearly 50 years, but most of the other records are much more recent.

THE SYMPTOMS OF THE DISEASE.

The most obvious symptom is the yellow spotting of the leaf surface, from which the disease derives its name. It usually appears some time during the wet season after at least a few weeks of rainy weather. It shows first on young leaves, but very frequently the spindle itself and the first one or two unfolding leaves are clean. The spots are very irregular in shape and size; many are tiny pin-points; the largest would be as large as a finger-nail. In the less severe infestations the spots are separate but in the heavier they coalesce to cover large areas of the leaf surface. As the leaves mature the spots increase in aggregate area and tiny reddish dots appear on the under surface; later they show on the upper surface also. A mycelial growth of a muddy white colour sometimes develops on the lower surface of the spots with an occasional sparse growth on the top surface. This mycelial down is very characteristic of the disease but does not show in all crops. Sometimes adjacent fields of the same variety, equally affected by the disease, will show very marked differences in down production; it may be very abundant in one and scarcely to be found at all in the other. The down is more persistent than that of downy mildew although on account of its dull colour is not as obvious to the untrained eye.

Apart from the effect of the hyphal threads, the surface of the leaf is not markedly altered by the fungus although in some leaves on which the down is scarce the surface looks slightly roughened, but is quite smooth to the touch.

As the leaves reach what would normally be full maturity the reddening of the spots increases markedly and at times all the green area of the leaf is destroyed. The leaf dies abnormally early and the net result is a big loss in active leaf tissue. In a badly affected field so little green may be present that from a distance the general colour is a rusty yellow. The early death of the mature leaves largely destroys the cover and even heavy crops look rather poor.

A close examination of the individual stalks gives the impression, owing to the green spindle, that recovery is occurring or will occur in the near future. However, observations over several months on many fields have shown that in the 1950 season at least, recovery did not occur, growth of the crop ceased when it would normally have been expected to continue, and that there was a very real loss.

A loss in c.c.s. is usually associated with yellow spot, both in Queensland and overseas, but whether it is due to the disease itself or whether it is due to the weather conditions which favour the disease, is impossible to determine.

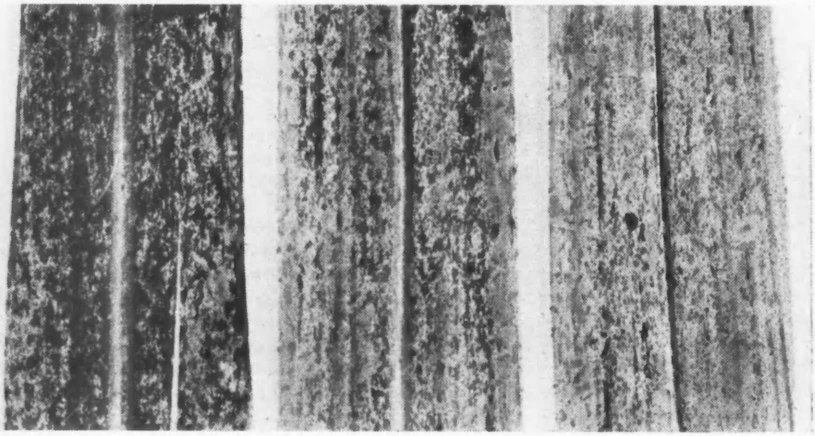

Fig. 50.—Yellow spot disease on the leaves of Trojan at Gordonvale during 1950.

THE CAUSE OF THE DISEASE.

The disease is caused by a fungus known by the name of *Cercospora kopkei*. There is not a great deal of information on this fungus since it cannot be grown in the laboratory for detailed examination. On the living cane leaves it produces bundles of short fungal threads growing out through the stomates or breathing pores, on the surface of the leaf. Since usually there are many more stomates on the under side of the leaf than on the upper, the threads are generally more obvious on the underside. The threads bear spores which may fall or be blown on to other parts of the same or neighbouring plants and so set up new centres of infection.

VARIETAL RESISTANCE AND CONTROL.

Observations in North Queensland indicated that Trojan and Eros are the two most susceptible varieties. Many fields of these varieties in the wetter areas in the North were badly affected and suffered some loss in tonnage through the early cessation of growth in autumn and a failure to grow through the early winter months. P.O.J.2878 also showed the disease but only a few fields of this variety were observed. Comus may be as susceptible as P.O.J.2878 but S.J.4 is less so. Badila showed a small amount but it was difficult to find the disease in Pindar, Q.44, and Q.50. It was obvious that the last few varieties are much less susceptible than Trojan and Eros.

It is interesting to note that in Java, P.O.J.2878 was regarded as very susceptible, and the Experiment Station there some years ago went so far as to make recommendations for the direct control of the disease by dusting the crops.

Such a method of control, even if 100 per cent. successful, would not be possible in Queensland, nor would the present status of the disease warrant any work along those lines. However, there are several ways in which the farmer may be able to lessen the incidence of the disease on his own farm:—

1. By not taking plants from badly diseased fields. Common sense dictates this but it is surprising how many farmers are willing to take a risk with planting material from a doubtful source.

2. By substituting more resistant canes for the susceptible Trojan and Eros, particularly in localities where the soil remains wet over long periods during the wet season and in fields which by their situation in hot, still areas in gullies or amongst tall timber, suffer very high humidities for prolonged periods. Either wet soil or wet atmosphere, or both together, are very favourable for the development of the disease.

CONCLUSION.

As mentioned above yellow spot is a new, damaging disease in North Queensland and it would be a rash prophet who would attempt to forecast what its status will be in a few years' time. At the very least, it is capable, we know, of causing some loss over several thousand acres during a long wet season; at the worst, it might lead to the discard of some valuable varieties through damage in a normal wet. The answer lies in the future but in the meantime the disease is being watched closely and should it prove to be serious, the accumulated experience of the Bureau in dealing with epidemics of major diseases together with the willing co-operation of the growers will weigh the scales against the disease and in favour of healthy, more profitable crops.

Use of B.H.C.—Warning to Growers.

Benzene hexachloride or "Gammexane" can be applied with fertilizer for protection against wireworms at the rate of 10 lb. of 20 per cent. B.H.C. per acre, but the heavier amounts necessary for grub control may cause serious trouble if applied in the same way.

In recent attempts to control grubs several cane growers have applied B.H.C. dust at the time of planting, either alone or mixed with fertilizer in the bottom of the drill in such a way that it came in contact with the plants. In all instances very poor strikes resulted. This was due to large quantities of B.H.C. coming in immediate contact with the sett roots, which then failed to develop.

At present the Bureau of Sugar Experiment Stations is carrying out experiments with this method of application, but the B.H.C. in these trials is kept away from the plants by a layer of soil. Until the results of these experiments are known, cane growers are not advised either to mix B.H.C. with fertilizer or to apply it in the drill at planting time when using the amounts required for grub control.

Furthermore, some cane growers have applied the B.H.C.-fertilizer mixture underneath the bottom of the drill by means of a vibrator and have thus avoided damage to the plants, but the further warning is made that there is a definite possibility that the band of B.H.C. so applied is too narrow and too deep for successful grub control, especially in the following ratoon crop.

Instead of these innovations which may sooner or later cause trouble, it is recommended that growers should adhere to the customary practice of applying the dust on the surface of the drill after the young cane has stooled sufficiently and just before the field is due to be worked level with cultivating implements.

A Tractor Driven Pusher Blade.

By N. McD. SMITH.

With a view to reducing manual labour on the farm, Messrs. Owen Bros., Paynter's Creek, Nambour, have attached a pusher blade to their Farmall "A."

The method of attachment is observed in the accompanying illustration. The blade has an upward movement of 4 inches which is sufficient for the job required. Use has been made of this "Baby Champion Grader" blade to fill in ditches after tiles have been laid and to level off spoil thrown out from open type main drains. It has been found that on a small scale, bulldozing is quite within the capacity of the implement provided the earth is in a friable state.

Under the conditions illustrated in the photograph, the 6-chain ditch which took 32 man-hours to dig by hand was covered satisfactorily in 17 minutes with the tractor operating in second gear.

The cost of the blade new was £16 but it is felt that a wooden type with a metal cutting edge could be constructed for a much smaller outlay.

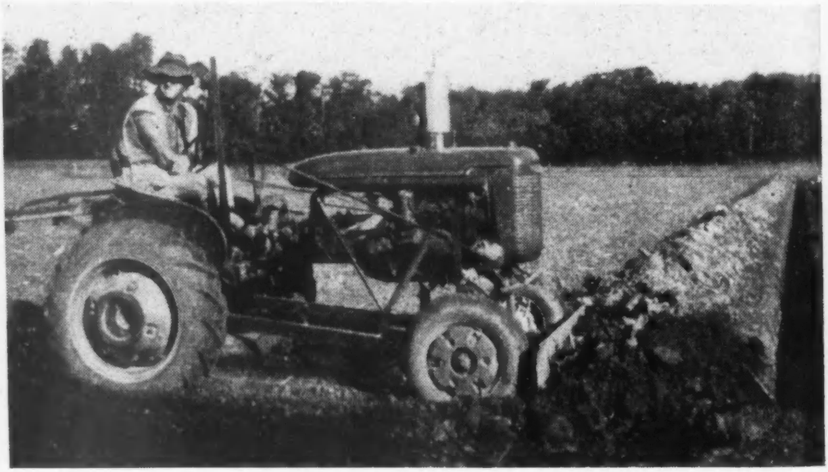

Fig. 51.—The pusher blade attached to a Farmall "A" tractor.

A History of the Sugar Industry.

The late Harry T. Easterby's history of the sugar industry in Queensland was published in 1932, and has since become a reference work on details of the early days of our industry. A limited number of copies of this profusely illustrated book are still available and copies will be forwarded to any growers or members of sugar mill staffs who apply for them. Applications should be addressed to the Director, Bureau of Sugar Experiment Stations, Brisbane.

The Improvement of Soils by the Application of Molasses and Sweet Sorghum Residues.

By L. G. VALLANCE and K. C. LEVERINGTON.

INTRODUCTION.

Most growers are aware of the necessity for maintaining their soil in good physical condition. Although the term "Physical condition" is used quite frequently the listener or reader is often not very clear as to what is actually meant. Briefly, it may be defined to mean the ability of the soil to be worked into a satisfactory tilth which is reasonably permanent. Such a soil remains open and loamy in texture and does not require a great deal of working to prevent it from setting hard under normal farming methods. On the other hand it does not become too loose and powdery with a very high rate of loss of moisture. In addition it will allow rain to penetrate quickly so that sufficient moisture will move down to the root zone. At the same time air will not be excluded but will remain in the soil where it can supply the much needed oxygen to the roots of the plant.

To pursue the question of physical condition a little further it may be pointed out that the mineral matter of a soil is formed of a number of small individual particles. The actual size of these particles is very important. On examination it will be found that they may be divided into four fractions according to size. These are:—

1. Coarse sand particles of diameter greater than .08 inch.
2. Fine sand particles of diameter varying from .08 to .008 inch.
3. Silt particles of diameter varying from .008 to .0008 inch.
4. Clay particles of diameter less than .0008 inch.

It is obvious that if a soil were completely composed of coarse sand particles, each of which are irregular in shape and greater than .08 inch in diameter, a large number of channels and passages will exist between them. Such a soil would be loose and open as indeed very sandy soils are. However, when a soil contains a large number of clay particles it can be readily imagined that these very small particles will fill up the pores and spaces between the grains of sand and will tend to form a consolidated mass.

The presence of clay is essential in a soil used for agricultural purposes since, among other things, it is the fraction that contains the nutrient material on which the plant grows. Under certain conditions, however, a somewhat clayey soil can be quite friable and loamy. This occurs when the minute individual clay particles bind themselves together to form small aggregates or crumbs. The term "structure" is used to refer to such a state of aggregation and undoubtedly the structure of a soil is most important from the point of view of physical condition.

FIELD TRIAL.

During recent years a considerable amount of attention has been directed to the influence of micro-organisms on soil structure. The binding effect of the threads of certain soil fungi is important in the formation of water stable soil crumbs from the clay and also the silt particles. Undoubtedly, there are other factors which influence the structure of the soil, but generally these factors do not change unless there is some interference with the natural conditions prevailing in the soil. Familiar examples are the formation of clods and hardpans from the use of unsuitable irrigation waters and the improvement in structure of some clay soils after liming.

The *life* of the soil is constantly changing and the development of living micro-organisms exerts a profound effect upon the characteristics of the soil. Such organisms depend upon the presence of

suitable organic matter for their existence, and substances which contain large amounts of readily decomposable carbohydrate material (such as sugar) promote the rapid growth of micro-organisms in general and fungi in particular. Both molasses and sweet sorghum residues contain appreciable amounts of sugars and therefore an experiment was set out in order to measure the effect of applications of these two materials on the structure of the soil. This trial (1) is still in progress and will be maintained for some time in order to investigate the permanency of the aggregates formed. However, since it has now been running for approximately six months and the treatments have undoubtedly improved the physical condition, it is felt that the results to date would be of interest to growers.

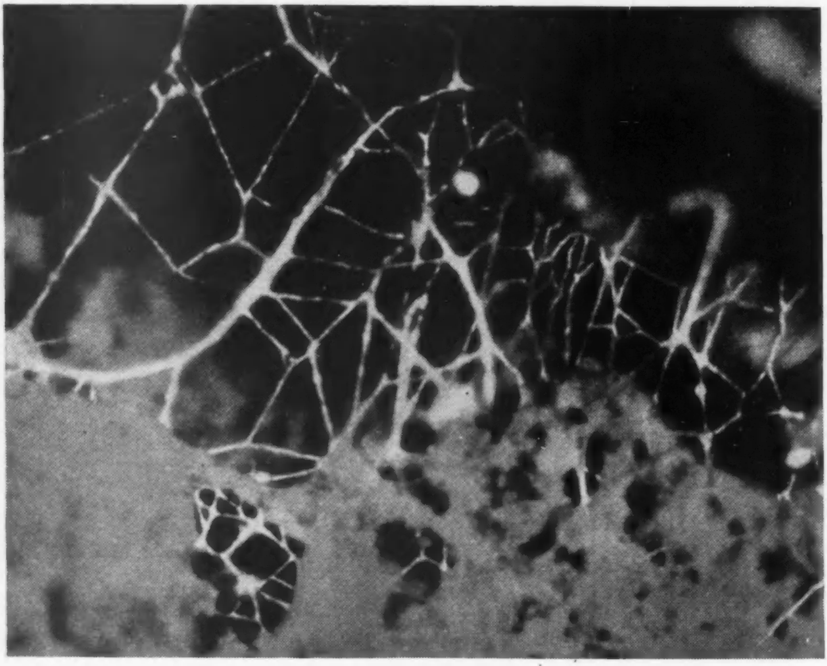

Fig. 52.—Showing the network of mycelial threads developed within a soil to which molasses has been applied. (Magnification X 120 approx.)

Five different treatments were used and these are as follows:—

(*a*) Molasses applied at the rate of 12 tons per acre.

(*b*) Molasses applied at the rate of 3 tons per acre.

(*c*) Sorghum residues applied at the rate of 35 tons per acre.

(*d*) Sorghum residues applied at the rate of 13½ tons per acre.

(*e*) Check plots which received no treatment.

Two varieties of sorghum—Honey and Sugar Drip—were used. These two were selected because of their normal prolific growth and high sugar content. (It may be mentioned that it is difficult to obtain quantities of seed of these particular sorghums since most commercial suppliers

do not segregate the several different varieties of sweet sorghums that are grown together and sold under the name Saccaline.) In order to satisfactorily handle the turning in of the residues on the experimental plots it was necessary to grow the sorghum outside the trial area, harvest it and apply the chaffed up material to the plots. The sorghum was harvested just before the grain was fully ripe since the plant at this stage contains approximately its maximum sugar content.

The molasses was poured evenly over the soil in an undiluted form and, like the sorghum residues, was thoroughly dug into the soil by hand forking to a depth of about 7 inches. The check plots, *i.e.*, those receiving no treatments, which were used for comparison, were dug in a similar manner. All of the plots were sampled before the treatments were applied and subsequent samples were taken at 14, 28, 61, 84, 146, and 174 days after the various applications had been made.

RESULTS OF FIELD TRIAL.

The results of the trial to date are shown in graphical form in Figure 53. From this diagram it is very evident that the treatments brought about a considerable increase in the percentage of aggregates or crumbs present in the soil of the differently treated plots. The bottom line, which represents the amount of aggregates in the untreated check plots, will be seen to remain approximately at the 10 per cent. level throughout the whole period. The most effective treatment was the 35 ton of sorghum application which quickly increased the amount of aggregates until about 40 per cent. of the soil was formed into crumbs. The next best treatment was the 12 ton application of molasses which steadily increased the number of crumbs in the soil until approximately 25 per cent. of the soil was aggregated. The light application of 3 tons of molasses was also appreciably beneficial and the soils so treated maintained a better physical condition than the check over the 174 days. The percentage of aggregates in this treatment rose to about 20 per cent. which was approximately twice that of the check plots. The benefit due to the 13½ tons of sorghum occupied an intermediate position between the two molasses treatments.

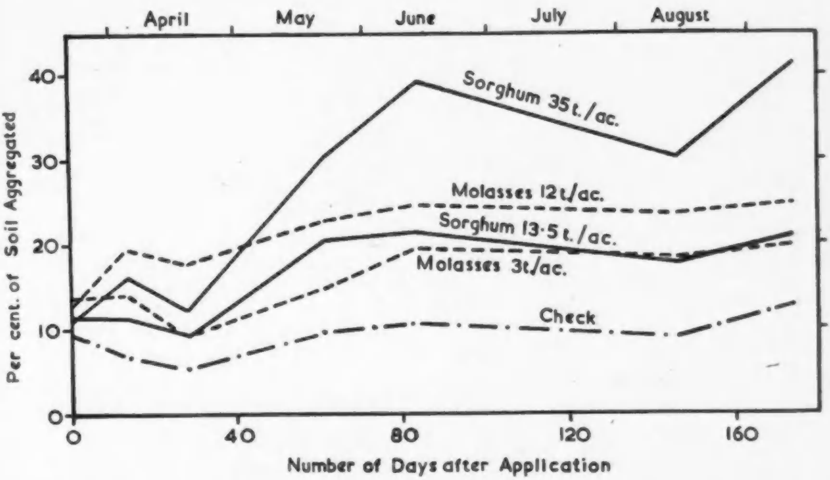

Fig. 53.—Illustrating the percentage of soil aggregated into crumbs at various times after the treatments were applied.

A point of interest that was observed during the trial was the effect of heavy rain on the structural aggregates. It will be noticed from the graph that a marked drop in the percentage of aggregates occurred in all treatments (including the untreated) in April and a somewhat similar decrease is also shown in August. Both of these periods were preceded by heavy rains which apparently brought about a deterioration of physical condition. This, however, was of a temporary nature only and the aggregates reverted to their former level as drier conditions returned.

The graph also shows that at the last date of sampling, which was 174 days after the molasses and sorghum was applied, not only was each treatment maintaining its beneficial effect, but there was a distinct tendency for further increase. The future behaviour of this trial should be interesting.

CONCLUSION.

Though at the present time it is a matter of conjecture as to what constitutes the most desirable degree of aggregation, it is apparent that applications of organic matter of high sugar content do improve the physical condition of the soil. It is already known from practical experience and experimental work over the years, that molasses applications often increase crop yields to an extent not always explained by the plant nutrient content of the dressings. It would appear, therefore, that an improvement in the tilth of the soil may have contributed towards the increased yields. The effect on the structure of the soil is of considerable interest and suggests that the use of the quick-growing sorghum plant as a cover crop may be very advantageous where the structure of the soil is naturally poor or has deteriorated under continuous cultivation.

An interesting point, also, is the probable effect of sugar cane itself on the soils on which it grows. It is not unduly unreasonable to suppose that the cane plant may be one which has a beneficial effect on soil structure, because of the relatively high sugar content of its stalk and stubble residues.

REFERENCE.

(1) VALLANCE, L. G., and LEVERINGTON, K. C.—The Effect of Molasses and Sweet Sorghum Residues on Soil Structure. Proc. 7th Cong. Inter. Soc. Sug. Cane Tech., 1950.

CORRESPONDENCE COURSE IN AGRICULTURAL SCIENCE.

The University of Queensland has, in conjunction with the Department of Public Instruction, inaugurated a Certificate Course in Agricultural Science which has been designed for the benefit of country dwellers. The course is a four year one but may be prefaced by a preparatory year in Chemistry and Physics for those whose standard of education is below that required for entrance. The subject matter of this course is wide and varied and includes such headings as Science of Plant and Animal Life, Science of Soils, Growing Crops, Nutrition, Animal Breeding, Animal Management, Horticultural Crops, Rural Economics, Soil Conservation, &c.

Being essentially a Correspondence Course, it is not designed to take the place of either a University degree or an Agricultural College diploma. During the period of the course enrolled students would study prepared lessons and undertake exercises associated with the lessons, and would sit for examinations. Upon successful completion of the course a Certificate in Agricultural Science would be awarded.

Any canegrowers' sons who may be interested in studying such a course should write to

The Supervisor,
Brisbane Technical Correspondence School,
Box 1389R, G.P.O.,
Brisbane,

for further particulars.

Q.55 in the Bundaberg Area.

By O. W. D. MYATT.

A general distribution of Q.55 in the Bundaberg and Gin Gin Area was made during the spring of 1950, when approximately 200 growers obtained 194 tons of the variety. Plantings have been made on all major soil types and it is considered that some advance information on the performance of this variety may assist growers in determining its suitability, or otherwise, to their own particular varietal requirements.

Q.55 was bred on the Bundaberg Experiment Station in 1938 and although its early life was overshadowed by more spectacular canes, it has, by virtue of its proven ability under adverse conditions, gradually earned its inclusion on the approved variety list for 1951. It is a seedling cane obtained by crossing P.O.J.2725 with Co.290 and is a sister cane of the varieties Q.48 and Q.51, and of similar parentage to the now famous Mackay variety Q.50.

Some growers have expressed the opinion that the use of Co.290 as a parent cane has marked all its progeny with a high susceptibility to red rot and rind disease, and this has led in many instances to the tardy adoption by some growers of promising seedlings. It is noteworthy, therefore, that Q.55 has, under harsh conditions on the drier soil types, shown a resistance to these stem rots and this, together with its trial tested resistance to downy mildew and mosaic disease, offers promise for the future of this variety under southern conditions.

It is a reddish-brown cane of medium thickness with a round prominent eye,

Fig. 54.—Showing the growth of Q.55 (right) as compared with another seedling under test for standover purposes.

which, as the season progresses, becomes enlarged and finally results in the shooting of top eyes in the latter part of the year (November-December). Early growth is somewhat sprawled but offers no cultivation worries; stooling is average and cover is good. Q.55 is a slower striking cane than the present district standard C.P.29/116 but results are reliable although its prominent eye generally restricts its planting time to the early spring months. It is a shy arrower, but in some plantings has produced an abortive top condition late in the season. Ratooning qualities are strong. Because of its high, early vigour combined with the shooting of top eyes late in the year, it is considered that this variety is not suitable as a standover type and its use in this direction is not recommended.

The accompanying photograph taken on the Bundaberg Experiment Station illustrates the vigorous growth of Q.55 in comparison with similar age seedlings thought to be more suitable as standover types. Sugar quality of Q.55 can be classed as above average and shows a steady improvement as the season progresses. High mill tests have been recorded during December and January despite the presence of top shoots. The above c.c.s. table, though limited, shows the general trend of quality during 1949.

Current varietal trials which include Q.55 have not yet been harvested, but its performance in propagation plantings throughout the district during 1949-50 may be summarised as follows:—

Woongarra Soils.					Red Forest Soils.					
Variety.	June.	July.	Aug.	Sept.	Variety.	June.	July.	Aug.	Sept.	Oct.
Q.55 ..	12·45	14·2	..	16·9	(1) Q.55 ..	..	..	14·6	15·2	16·3
C.P.29/116	12·0	14·3	..	16·1	Q.47 ..	..	..	13·6	14·8	16·0
					(2) Q.55 ..	13·1	14·8			
					Q.47 ..	12·9	14·3			

Germinations were good on all soil types and its early vigour kept it ahead of other varieties. Growth on the alluvial flats was marked by heavy stooling and an increase in stalk thickness, resulting in excellent yields. Plantings on the volcanic soils were somewhat restricted but in all cases gave better than average crops, whilst on the forest lands growers have expressed approval of its heavy cropping, even on the poorer grey soils. Worthy of note also, are its drought resistant qualities. These qualities were exhibited in the Bullyard-McIllwraith area during 1948, and growers here have been particularly keen for its inclusion as an approved variety.

However, perhaps its greatest asset displayed during this year was its shy arrowing and consequent late growth, which in this heavy arrowing season enabled most plots to easily outweigh the heavily arrowed standards. Whilst it is realised that Q.55 is not, by any means, a spectacular cane, its reliable performance, particularly on the drier forest soils, cannot be overlooked and mark it as a variety well worthy of consideration in future plantings.

Some Notes on Cane Irrigation.

By G. A. CHRISTIE.

In assessing the suitability of climatic conditions of a district for cane growing, the average annual rainfall is often considered, for it is recognised that cane makes most satisfactory growth under tropical or sub-tropical conditions, where soil moisture is readily available to the plant. However, the distribution of this rainfall is very important for throughout most of the coastal belt of Queensland, upwards of 90 per cent. of the annual precipitation occurs during a three or four months wet season. Even in some of the so-called "wet" areas of the tropics, drought conditions very often prevail during the late winter, spring and early summer months, when the growth of young crops may be checked severely for long periods. Naturally such growth checks cause crop losses and many cane growers have given thought to the artificial application of water, where water is available for irrigation.

Water which falls on the soil may be lost from that soil in the following ways:—

(*a*) Surface run-off may account for a fairly large amount when heavy downpours occur, particularly if the surface of the soil will not permit rapid absorption, and when steep grades are found. This may cause severe soil erosion, particularly in hilly areas.

(*b*) Downward seepage may carry large quantities of water out of the reach of plant roots in areas where a permeable subsoil allows a free downward movement.

(*c*) Evaporation from the soil surface dissipates a considerable amount of soil moisture in warm, dry, windy weather.

(*d*) Water absorbed through plant roots is essential for plant growth. It carries plant foods from the soil, and in addition to being a necessary food, it takes part in the chemical processes associated with plant life.

Water transpired by the cane plant is the useful or productive part of the total moisture, and in dry weather, the agriculturist should aim at minimising losses by other methods listed above, but in long wet periods, a rapid removal of excess water by a suitable drainage system, should be attempted. Grasses and weeds in cultivations also use up water in the same way as the cane crop, and they should be kept in check to ensure that water used by transpiration goes into the formation of the productive crop.

It has been ascertained that between 1¼ and 1½ acre inches of water (1 acre inch being approximately 22,600 gallons or 100 tons) pass through the cane plant in the production of 1 ton of cane. Thus for the growth of a 40 tons per acre crop 50 to 60 acre inches of water would be used by the plant. However, when surface run-off, downward seepage and evaporation are taken into consideration, this figure may easily be doubled, depending, of course, on local conditions of land slopes, subsoil and temperatures. From these figures, it will be understood readily why, in many areas, crop growth is restricted, in spite of the fact that ample plant food is supplied in the form of artificial fertilizer. It must be stressed at this stage that a crop cannot make full use of a large amount of fertilizer if the water supply is restricted and *vice versa*.

Methods of obtaining water are dependant on local conditions throughout the sugar belt of Queensland. In some localities a fresh water stream or permanent water hole may be the source of supply for a pumping unit, while in other areas, underground water may be available. In the latter case, spears, consisting of a perforated tube surrounded by fine gauze, are used. The gauze covering prevents the entry of sand into the pump but does not impede the flow of water. The quality of water used for irrigation is a most important consideration, for some chemicals in solution may cause damage not only to the crop but also to the soil. It is suggested

Fig. 55.—Showing main ditch with pipe ready to lead water into the cane row.

that cane growers should take advantage of the free service of this Bureau in submitting water samples for analysis, for occasionally waters have been tested and found unsuitable for irrigation though injurious chemicals cannot be detected by taste.

Practically all pumps used for irrigation of cane farms are centrifugal types and the sizes of units installed are dependant on the amount of water available, and the area to be irrigated. As a rough guide, it is suggested that a pump should be able to supply at least 1,000 gallons per hour per acre to be irrigated. For instance a 50 acre farm should have a pump capable of producing 50,000 gallons per hour to ensure frequent watering during hot dry periods when crops may otherwise suffer severely from drought conditions.

Motive power for pumps varies throughout the State, though most are stationary internal combustion engines or electric motors, while tractors fitted with a belt pulley are seen on some farms. Steam and suction gas engines are being replaced because of the increased cost of fuel and the fact that they require more regular attention than other forms of power.

Water is conducted from the source of supply to various parts of the farm in a number of ways.

(*a*) Earth drains, though not costly to construct, require regular attention to control weed and grass growth, and in some soils the loss of water from seepage may be appreciable. They are necessary as feeder drains on headlands and through cane fields, where they are broken down at each cultivation and remade for the following irrigation.

(*b*) Permanent galvanized iron trough fluming was popular a number of years ago, but the high initial cost and maintenance have led to this system being discarded.

(*c*) Round galvanized iron fluming has been used extensively, and it still finds favour on many farms, but in recent years, material for its construction has been difficult to procure.

(*d*) Reinforced concrete pipe, though costly to install, provides the most permanent method, and it requires very little attention if correctly laid.

Obviously it is necessary to deliver water to the higher points of the field to be watered, and from these points it is conducted along ridges in feeder drains for distribution into individual rows where it flows to the lower sections by gravity. The setting out of some fields requires considerable ingenuity on the part of the cane grower, and practical experience shows the most suitable direction for cane rows and location of feeder drains.

In the Burdekin area, which is the largest irrigated cane district of the State, practically all cane growers irrigate down the cane drill until cultivation

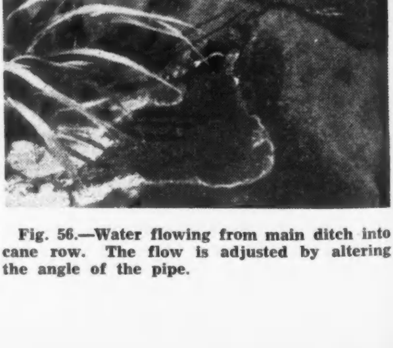

Fig. 56.—Water flowing from main ditch into cane row. The flow is adjusted by altering the angle of the pipe.

Fig. 57.—Underground concrete pipes replace open ditches, save water, and reduce maintenance.

of the interspace between rows becomes impracticable, and after the final cultivation when drills are "hilled-up," irrigation is continued in the flat interspace between drills. In order to control the flow of water into each furrow, the bank of the feeder drain is pierced by a short length of tube, one or two inches in diameter, and the flow is controlled by inserting extra tubes or by partly blocking the tube. An alternative method is to make a V-shaped depression in the drain bank, and a small piece of bag placed in this depression prevents washing of the bank while water flows over it.

For uniform distribution of water, the distance between feeder drains should be restricted to between 4 and 8 chains depending on the type of soil, for when distances are increased, soil at the point of entry of water may receive a complete saturation, while that section of the field more distant from the point of entry of the water, may get only a light wetting. Obviously, using long distances between feeder drains is more wasteful with water, but in some areas where the water supply is plentiful, cane growers often find it less costly to waste a little water and save on labour, for shorter drills require more frequent supervision of water flow.

Furrow irrigation, as briefly outlined above, is used on practically all irrigated cane farms in the State though a few spray systems are also employed. The high initial cost and maintenance of spray lines, and the difficulties of obtaining a uniform spread in windy weather, are factors against the spray system, though users claim that they require less labour since once the sprays are in position, they can be left unattended for some hours, until the required amount of water has been applied.

An important question which should be discussed, is when and how much water should be applied to the crop. Frequency of watering is determined by the cane grower following an examination of the soil. However, it is suggested temperatures should also be considered, for a correlation between cane growth and mean temperatures has established the fact that rapid growth can be expected when the mean temperature rises above 70°F. provided there is no deficiency of plant food and moisture. As temperatures drop below 70°F. the growth rate is also reduced. Thus a useful guide on the frequency of watering would be that for maximum growth, soil moisture should be kept near the optimum when the mean temperature rises above 70°F. In the cool winter months, when growth is reduced, waterings should be less frequent.

The amount of water which should be applied at each irrigation, depends on the stage of growth of the crop, for unnecessary wetting of the soil out of range of the crop roots only induces the growth of weeds and grasses. Obviously the aim with newly planted or very young cane should be a wetting of the area near the plant, while in the more advanced crop, a wetting of both row and interspace should be achieved when the roots extend over the complete interspace.

Fig. 58.—A grass covered main ditch is costly to clean and maintain.

The Cultivated and Wild Canes of New Guinea.

By NORMAN J. KING.

Prior to the recent world conflict, an important part of which was determined on the island of New Guinea, relatively little was understood of that country or of its inhabitants. It is difficult to appreciate the conditions which must have existed in that primitive island some fifty odd years ago when the Cowley and the Tryon expeditions travelled by boat from Queensland to search for sugar cane varieties for our industry. New Guinea is acknowledged by world sugar authorities to be the native habitat from which spread around the globe all the early sugar cane types which were responsible for the world's cane sugar supply. It is not to be wondered at, therefore, that several expeditions visited that country hoping to obtain new material to suit particular localised conditions.

The Queensland Government pioneered the quest for New Guinea canes in 1893 when it sent Ebenezer Cowley—overseer of the State Nursery at Kamerunga—to the island to collect cane varieties. The result of his visit was eleven named varieties, but although some were grown for many years, none achieved prominence in the industry.

Three years later another expedition, under the leadership of Henry Tryon, was organised by the Queensland Government and this resulted in a collection of 66 varieties from the south-east coastal areas between Port Moresby and Milne Bay. The value of this collection to the Queensland industry can never be estimated since it contained such varieties as Badila, Mahona, and the Gorus.

In 1912 the Government sponsored still a third search of this territory under the leadership of T. W. Wells of Childers and 158 varieties ultimately reached the Sugar Experiment Station at Mackay, but none survived the trials to which they were subjected in Queensland cane areas.

Two years later the C.S.R. Co. sent Mr. Carne to make a collection of New Guinea canes and he forwarded 103 types which included Oramboo, Korpi, and Nanemo.

These four expeditions had one end in view—that of discovering commercial varieties which might develop successfully in the Queensland environment. Cane breeding was an infant science at that time and no conscious attempt was made to collect canes with a view to utilisation as parents. It was not until 1928 that the United States Department of Agriculture expedition under E. W. Brandes searched the coast and rivers of the territory for breeding types of *S. officinarum*, *S. spontaneum* and *S. robustum*. This party, travelling by seaplane, succeeded in locating and transporting 288 varieties, many of which have since been used in breeding programmes. This was followed in 1937 by an expedition from the Experiment Station of the Hawaiian Sugar Planters' Association, which concentrated on collection of true seed from the arrows of wild canes. This, incidentally, was the first party to enter the New Guinea highlands in search of sugar cane types.

The demands in all sugar growing countries for more vigorous and more disease resistant varieties resulted in breeding programmes which used as basic materials the wild, thin canes which possessed little or no sugar but had the characters of vigour and hardiness. Crossing with noble canes resulted in a new race of sugar cane seedlings which, as a result of further crossing and consequent dilution of the wild blood, gave a plenteous supply of new types with an improved standard of vigour and disease resistance.

The higher numbered P.O.J. canes and the Co. types were examples of this method of breeding and many of the Bureau bred "Q" canes and the C.S.R. productions also owe their vigour and hardiness to similar blood lines. Recently, the Bureau has raised seedlings containing one-eighth *S. robustum*—another New Guinea wild cane—which are promising commercial types and the use of this species opens up still further vistas to the cane breeder.

New Guinea abounds in both cultivated and wild canes. The cultivated types are grown in the native gardens and are thick, soft and sweet, since the natives use them for chewing purposes and select them accordingly. It was in these native gardens that the early searchers such as Tryon, Cowley, Wells, and Carne made their collections and in which were found Badila, Oramboo, Korpi, Goru, Mahona, etc.

Fig. 59.—Part of a native garden. Note the occasional cane stools. The poor stooling is the result of the natives breaking out matured stalks for chewing purposes.

The New Guinea native garden would appear to a canegrower as an example of planned chaos. Surrounded by a fence of wild cane stalks closely tied together and impenetrable to animals, the garden may occupy an area of about a quarter of an acre. Neatly cultivated and surface drained, the garden is planted in rows but here the resemblance to a cane field finishes. A stool of cane is followed by a taro plant, a banana stool, a flowering shrub and perhaps a sweet potato vine before one sees another cane stool. Paw-paws, corn, and in fact all food yielding plants occur in these mixed plantings, and inevitably a generous sprinkling of shrubs and flowers, for the native has a well developed colour sense. The result is an attractive but utilitarian garden which provides the family food supply and which lacks the monotone of agriculture in this country. An interesting plant observed in these gardens, but not identified, was a thick, soft-stemmed, cane-like growth with variegated leaves, the inner spindle of which when cooked has the flavour of asparagus.

The wild canes occur in both highland and lowland New Guinea up to and perhaps above 8,000 feet elevation. They grow in moist areas, along creeks and rivers and in valleys, forming tangled masses of thin wiry stalks and containing a range of varieties. These types are known locally as cane grass, or by the natives as "pit-pit" and are used for building fences around gardens to keep out wild pigs as well as for native hut construction. For the latter purpose the hollow stemmed types are hammered out to flatten them and are then woven into attractive designs for walls.

In these areas of wild canes exists a profusion of breeding material which could keep the world's cane breeders busily occupied for generations. It is from such a source that the Queensland industry might expect the varieties of the future.

The decision to send another party into that country was prompted by the undoubted need for early maturing canes for our industry. New Guinea has in the past, given us Oramboo, Korpi, and Mahona, all of which possessed that elusive character of high early sugar. Together with Q.813, B.208, Clark's Seedling and S.J.2 we possessed a goodly array of early varieties but all carried certain undesirable features either of poor ratooning, lack of vigour or disease susceptibility and most have gone into the discard. From the canebreeder's point of view the worst feature, and it was common to all, was the failure to arrow except on rare occasions. This prevented their use in systematic and continuous breeding and greatly decreased our chances of raising early maturing seedlings.

It was argued—we hope rightly—that the New Guinea natives, through generations of growing chewing canes had probably practised a system of selecting and replanting the sweetest types and that these should include a proportion of varieties with high early sugar. Such

varieties could have a two-fold application to our industry. Firstly, they might be suitable commercial varieties and secondly they might be good arrowers and be useful in the breeding programme. For the former purpose canes with desirable agricultural characters would need to be selected, but for the latter the high sugar and good arrowing would be the prime features required since vigour could be bred into them.

In addition to the quest for early maturity there are other phases of our breeding programme which could be assisted materially by New Guinea canes. It is known that both Fiji and downy mildew diseases exist in that territory, and it would be the aim of our expedition to select in the diseased areas both wild and cultivated types which show no symptoms of infection. Having grown for years in a diseased environment it is probable that any disease-free individuals are resistant and such canes would be of inestimable value as breeding stock. In just the same way as the Glagah blood line conferred gumming resistance on the higher numbered P.O.J. canes, so we may expect to find Fiji resistant wild canes which would do the same for that disease.

The routes covered by previous expeditions are well known and since those times many other parts of New Guinea have been explored by the local administration. Air services have opened up what was unknown country ten years ago and the facilities for cane collecting are much improved. This does not mean that the country is intimately known. There are still many vast tracts which are unexplored and in most of the territory foot transport is the only means of progress.

The writer made a short visit to New Guinea during October, 1950, to investigate the practicability of a Bureau expedition in the early part of 1951. Discussions were held with the Administration officials and with the Department of Agriculture, and visits were made to certain highland and lowland areas. It was found that every assistance would be given to our staff and from personal observation it appeared that a wealth of material existed in both native cultivations and in the wild state. On this expedition the personnel will be Mr. J. H. Buzacott (Senior Cane Breeder) and Mr. C. G. Hughes (Pathologist) and the experience of both men ensures that due precautions will be taken to prevent the introduction into Queensland of any disease or insect. They will concentrate their searches in the lowland Mekeo district, some 70 miles north-west of Port Moresby and in the highland district about 100 miles west of Lae at an elevation of 5,000 to 6,000 feet. However, it is possible that other areas may be visited by the party if reports received by them suggest that good collecting may be achieved elsewhere.

Fig. 60.—Part of a field of wild canes growing at Gooska in the New Guinea highlands (elevation 5,550 ft.). Such fields contain many varieties of the hardy wild species valuable as breeding canes.

New Guinea is a vast island and should our beliefs in its potentialities be realised on this particular trip, other ventures can be planned for future years. It is known that sugar cane occurs under similar conditions in many parts of the territory which have not yet been visited by collectors and, so far as we are aware, that section of the island governed by the Netherlands Government has never been examined for native canes. In addition the adjacent islands of New Britain, New Ireland, Bougainville, etc., are fields for later exploration.

A visitor cannot fail to be impressed firstly by the vastness of the territory and secondly by the extent of good quality agricultural land which is, at present, not utilised for any purpose. The great Markham Valley with its extensive areas of flat alluvial soil appears large enough to feed all the peoples of New Guinea, but no sign of cultivation was seen in 50 miles of its length. The highland valleys are almost as extensive. One cannot but speculate on the future of this country which possesses almost limitless potentialities for production. Rubber and copra are grown on plantations to a limited extent but both are capable of enormous expansion. The range of climate between lowland and highland would allow of Australia's requirements of coffee, tea, and spices being produced, whilst many localities would appear to be ideal for rice growing on a large scale. New Guinea is rich in natural resources but little has been done to date to exploit them.

Fig. 61.—A wild cane in tassel in the New Guinea highlands.

"THE SUGAR EXPERIMENT STATIONS ACTS, 1900 TO 1948."

List of Varieties of Sugar Cane Approved for Planting in 1951.

Department of Agriculture and Stock,
Brisbane, 1st January, 1951.

Mossman Mill Area.

Badila, Cato, Clark's Seedling, Comus, D.1135, Pindar, P.O.J.2878, Pompey, Q.44, Q.50, S.J.4, and Trojan.

Hambledon Mill Area.

Badila, Badila Seedling, Cato, Comus, D.1135, Eros, Pindar, Pompey, Q.44, Q.50, and Trojan.

Mulgrave Mill Area.

North of Fig Tree Creek.

Badila, Badila Seedling, Cato, Comus, D.1135, Eros, H.Q.426, Pindar, P.O.J. 2878, Q.44, Q.50, and Trojan.

Babinda District.

Badila, Badila Seedling, Cato, Clark's Seedling, Comus, Eros, Pindar, Q.44, Q.50, and Trojan.

South of Russell River.

Badila, Badila Seedling, Clark's Seedling, Eros, Pindar, Q.44, Q.50, S.J.4, and Trojan.

Babinda Mill Area.

Badila, Badila Seedling, Cato, Clark's Seedling, Comus, Eros, Pindar, Q.44, Q.50, and Trojan.

Goondi Mill Area.

Badila, Badila Seedling, Clark's Seedling, Eros, Pindar, Pompey, Q.44, S.J.4, and Trojan.

South Johnstone Mill Area.

Badila, Badila Seedling, Clark's Seedling, Eros, Pindar, Q.44, Q.50, S.J.4, and Trojan.

Mourilyan Mill Area.

Badila, Badila Seedling, Clark's Seedling, Eros, Pindar, Q.44, Q.50, S.J.4, and Trojan.

Tully Mill Area.

Badila, Badila Seedling, Clark's Seedling, Eros, Pindar, Q.44, Q.50, and Trojan.

Victoria Mill Area.

Badila, Eros, Orion, Pindar, P.O.J. 2878, and Trojan.

Macknade Mill Area.

Badila, Eros, Orion, Pindar, P.O.J. 2878, and Trojan.

Invicta Mill Area.

North of Townsville.

Badila, Comus, Eros, Pindar, P.O.J. 2725, Q.50, and Trojan. The variety Clark's Seedling may be planted only in the section south of Cattle Creek.

South of Townsville.

Badila, B.208, Clark's Seedling, Comus, E.K.28, Pindar, P.O.J.2714, S.J.2, S.J.4, S.J.16, and Trojan.

Pioneer Mill Area.

Badila, B.208, Clark's Seedling, Comus, E.K.28, Pindar, P.O.J.2878, S.J.2, S.J.16, and Trojan.

Kalamia Mill Area.

Badila, B.208, Clark's Seedling, Comus, E.K.28, Pindar, P.O.J.2878, S.J.2, S.J.16, and Trojan.

Inkerman Mill Area.

Badila, B.208, Clark's Seedling, Comus, E.K.28, Pindar, P.O.J.2878, S.J.2, S.J.16, and Trojan.

Proserpine Mill Area.

Badila, Clark's Seedling, Co.290, Comus, E.K.28, M.1900 Seedling, Pindar, P.O.J.2878, Q.28, Q.45, Q.50, Q.813, S.J.2, and Trojan.

Cattle Creek Mill Area.

Badila, Badila Seedling, Clark's Seedling, Co.290, Comus, E.K.28, M.1900 Seedling, Pindar, P.O.J.2725, P.O.J. 2878, Q.28, Q.45, Q.50, S.J.2, and Trojan.

Racecourse Mill Area.

Badila, Badila Seedling, Clark's Seedling, Co.290, Comus, E.K.28, M.1900 Seedling, Pindar, P.O.J.2725, P.O.J. 2878, Q.28, Q.45, Q.50, Q.813, S.J.2, and Trojan.

Farleigh Mill Area.

Badila, Badila Seedling, Clark's Seedling, Co.290, Comus, E.K.28, M.1900 Seedling, Pindar, P.O.J.2725, P.O.J. 2878, Q.28, Q.45, Q.50, S.J.2, and Trojan.

North Eton Mill Area.

Badila, Badila Seedling, Clark's Seedling, Co.290, Comus, E.K.28, M.1900 Seedling, Pindar, P.O.J.2725, P.O.J.2878, Q.28, Q.45, Q.50, Q.813, S.J.2, and Trojan.

Marian Mill Area.

Badila, Badila Seedling, Clark's Seedling, Co.290, Comus, E.K.28, M.1900 Seedling, Pindar, P.O.J.2725, P.O.J.2878, Q.28, Q.45, Q.50, S.J.2, and Trojan.

Pleystowe Mill Area.

Badila, Badila Seedling, Clark's Seedling, Co.290, Comus, E.K.28, M.1900 Seedling, Pindar, P.O.J.2725, P.O.J.2878, Q.28, Q.45, Q.50, Q.813, S.J.2, and Trojan.

Plane Creek Mill Area.

Badila, Badila Seedling, Clark's Seedling, Co.290, Comus, E.K.28, M.1900 Seedling, Pindar, P.O.J.2725, P.O.J.2878, Q.28, Q.45, Q.50, Q.813, S.J.2, and Trojan.

Qunaba Mill Area.

C.P.29/116, Co.290, Pindar, P.O.J.213, P.O.J.2878, Q.25, Q.42, Q.47, Q.48, Q.49, Q. 50, and Q.55.

Millaquin Mill Area.

C.P.29/116, Co.290, Pindar, P.O.J.213, P.O.J.2878, Q.25, Q.42, Q.47, Q.48, Q.49, Q.50, and Q.55.

Bingera Mill Area.

Atlas, C.P.29/116, Co.290, Pindar, P.O.J.2725, P.O.J.2878, Q.25, Q.42, Q.47, Q.48, Q.49, Q.50, and Q.55.

Fairymead Mill Area.

C.P.29/116, Co.290, Pindar, P.O.J. 2878, Q.25, Q.42, Q.47, Q.48, Q.49, Q.50, and Q.55.

Gin Gin Mill Area.

C.P.29/116, Co.290, Co.301, Mahona, M.1900 Seedling, Pindar, P.O.J.2714, P.O.J.2878, Q.25, Q.42, Q.47, Q.48, Q.49, Q.50, Q.55, Q.813, and Vesta.

Isis Mill Area.

C.P.29/116, Co.290, Co.301, Pindar, P.O.J.213, P.O.J.2878, Q.25, Q.42, Q.47, Q.48, Q.49, Q.50, and Q.51.

Maryborough Mill Area.

Pialba District.

C.P.29/116, Co.290, Co.301, P.O.J.213, P.O.J.2878, Q.42, Q.47, Q.49, and Q.50.

Maryborough District.

C.P.29/116, Co.290, Co.301, M.1900 Seedling, P.O.J.213, P.O.J.2878, Q.42, Q.47, Q.49, and Q.50. Q.25 may be planted only on those farms loading cane at sidings on the North Coast Line from Mungar South.

Mount Bauple Mill Area.

C.P.29/116, Co.290, M.1900 Seedling, P.O.J.213, P.O.J.2878, Q.25, Q.42, Q.47, Q.49, and Q.50.

Moreton Mill Area.

C.P.29/116, Pindar, Q.28, Q.42, Q.47, Q.50, Trojan, and Vesta.

Rocky Point Mill Area.

C.P.29/116, Co.290, H.Q.285, Oramboo, P.O.J.2878, Q.28, Q.42, Q.47, Q.49, Q.813, and Trojan.

NORMAN J. KING,
Director of Sugar Experiment Stations.

"THE SUGAR EXPERIMENT STATIONS ACTS, 1900 TO 1948."

Department of Agriculture and Stock,
Brisbane, 1st January, 1951.

APPROVED FODDER CANES.

All farmers are advised that the following are the varieties of cane which may be grown for fodder purposes in the sugar mill areas as set out below:—

Hambledon and Mulgrave Mill Areas.

China, Uba, Co.290, and "Improved Fodder Cane."

Mossman, Babinda, Goondi, South Johnstone, Mourilyan, Tully, Victoria, Macknade, Invicta, Pioneer, Kalamia, and Inkerman Mill Areas.

Uba, Co.290, and "Improved Fodder Cane."

Proserpine, Cattle Creek, Racecourse, Farleigh, North Eton, Marian, Pleystowe, and Plane Creek Mill Areas.

China, Uba, and "Improved Fodder Cane."

Qunaba, Millaquin, Bingera, Fairymead, Gin Gin, Isis, Maryborough, Mount Bauple, Moreton, and Rocky Point Mill Areas.

90 Stalk, "Improved Fodder Cane," and C.S.R.1 (also known as E.G.).

NORMAN J. KING,
Director of Sugar Experiment Stations.

Varietal Deterioration in Queensland.*

NORMAN J. KING,
Bureau of Sugar Experiment Stations, Queensland.

The agricultural side of the sugar industry has reached the point, in most countries, of staging a continuous and never-ending varietal revolution. The reasons for varietal replacement vary from country to country but are, in the main, included under the following headings:—

- (*a*) An attempt to increase yield per acre.
- (*b*) Replacement of disease-susceptible by disease-resistant varieties.
- (*c*) Introduction of types more suitable for such operations as mechanical harvesting.
- (*d*) Search for canes which are earlier maturing, frost resistant, drought resistant, etc.
- (*e*) Fight to overcome senescence or running out or, in other words, to maintain yields.

The principal aim in most sugar industries is however that of increasing unit yields, and after assuming that soil practices have been properly exploited, the desired improvements can be accomplished only by introduction of better varieties into the industry. Depending on the country concerned, this is achieved by varietal importation or by local cane breeding. During the past twenty years most sugar-producing countries have altered the status of the local industry by either of these means. Cane breeding has met with a generous measure of success and varietal changes have in some cases brought about appreciable increases in average production. However, there appears to be a general feeling among geneticists that the improved yield capacity of most new hybrid canes has a limited life and that yields gradually fall to such an extent that replacement is merely a matter of time. Some authorities have gone so far as to suggest that the useful life of a new variety may be only ten years.

When it is considered that the old "noble" canes, which formed the basis of most sugar industries, had such a long life the failure of the modern hybrids to survive such a short period is rather disturbing. Although Queensland's sugar history is a relatively short one—going back only eighty years or so—there is an excellent example of maintenance of virility in the variety Badila. This was introduced from New Guinea fifty-four years ago and continues to be a major cane in the industry. So far as is known, there is no tendency to give progressively reduced yields or to show signs of senescence. Most of the "noble" canes succumbed to diseases in various countries and had, for that reason or some other equally important one, to be replaced. But the replacements, when made with hybrids, have not demonstrated the same capacity for long life under the same set of conditions.

Various theories have been advanced to explain the condition which has become known almost universally as the "running out" of varieties. Under the conditions of sugar-cane crop growth, where reproduction is a vegetative process, the fundamental yielding capacity of a variety remains unchanged. Since a "variety" is botanically a clone with a fixed genotype any variation in stools in a field can be due only to a difference in environment. Similarly any variations in yield between fields of the same variety in different locations or different years must be due to differences in fertility levels, attacks by diseases or pests or changing climatic conditions.

Acceptance of these facts narrows down the cause of varietal deterioration to several possibilities which it is proposed to consider separately and briefly in relation to Queensland.

* Paper presented at the Seventh Congress of the International Society of Sugar Cane Technologists.

1. DECLINING FERTILITY OF SUGAR-CANE PRODUCING SOILS.

This explanation, by reason of its simplicity, is most generally put forward to explain any dropping-off of yields. Thirty or forty years ago this claim would, no doubt, have been fully justified because of the heavy drain on the soils and the fact that fertilizing was in its infancy. There is little doubt that, at that time, soil nutrients were being depleted. During recent times, however, the system of soil analysis and fertilizer trials which go hand in hand with an extensive advisory service have resulted in an intelligent fertilizing routine which is tending to raise the fertility status of our soils.

The cane growers of this State now possess a fairly complete understanding of the nutrient requirements of their lands and the gradually increasing tonnage of fertilizer used indicates a growing awareness of the needs of the crop. Fertility surveys conducted annually in several areas do not suggest any deterioration in plant foods.

2. DEVELOPMENT OF UNFAVOURABLE PHYSICAL CONDITION.

There is reason to believe that certain of our sugar-producing soils do not possess the same desirable structure which they had as virgin land. The years of implement working—sometimes under too wet or too dry conditions—the impact of truck and tractor tyres, the compaction during harvesting operations, and several other factors have contributed to this deterioration. It is logical to assume that loss of structure could affect crop development by affecting adversely soil aeration, root development, drainage, etc. On the other hand, certain of our principal sugar-producing soil types are of excellent structure, which does not appear to be appreciably different to that of adjacent, virgin land. The claims regarding varietal deterioration are, however, equally emphatic on these soils of unchanged physical condition so it would not appear that a change in soil structure is the answer to the problem.

3. THE EFFECTS OF DISEASES AND PESTS.

Although this State possessed at one time most of the major cane diseases of the world, the last twenty years have witnessed either their complete eradication or their relegation to minor occurrences. They can no longer be considered as playing a part in varietal deterioration. Similarly, the major cane pests have been effectively controlled but, in any case, pests never played any conspicuous part in several districts where varietal change has been an important feature of the industry.

4. SYMPTOMLESS OR UNIDENTIFIED DISEASES.

There is evidence in Queensland to suggest that varietal deterioration may be due to minor diseases not possessing easily recognisable symptoms. Bell [1] discussed "sick" soils and their effect on the variety Q. 813. In this case it was shown that steam sterilization of the soil resulted in an increase in root weight by 250 per cent. and an improvement in above-ground weight by 275 per cent. Sterilization apparently removed some growth-inhibiting factor which in that case was possibly parasitic soil fungi. In this cane grown on non-sterilized soil there were no outward symptoms to indicate that an organism was taking its toll of the crop, except that both root and stalk development were stunted. This was a case, undoubtedly, of a variety "running out" because of the build-up of a soil organism in sufficient quantity to inhibit root development and ultimately the growth of the crop. The organism was not systemic, so that the plants, if taken on to sterilized soil, grew normally.

On the other hand we now have experience of a new disease [2], in the variety Q. 28, the origin of which is unknown, but which is also symptomless, inasmuch as there are no outward or inward symptoms except a severe stunting of the ratoon crops. The disease is systemic and can be transmitted to healthy plants by juice inoculation from diseased plants. It can be spread by cane knives, and, accordingly, a grower with a single stool of the diseased cane could, by always

using his own plants, ultimately infect his entire crop. The severity of the yield reduction in this case drew the attention of pathologists to the problem, and the fact that a disease existed was soon established. If the stunting had been less severe—or the variety more tolerant to it—the gradual loss of vigour would perhaps have been claimed as one more example of varietal deterioration.

It is difficult in the presence of such factors to measure, with any degree of precision, what effect any new variety in the industry may have on improving commercial yields. New seedlings are, in general, assessed on their performance in a series of progressive trials in which they are compared initially with commercial standard canes. During this period of comparison the trials are, perforce, restricted to small plot areas in selected localities and there is little opportunity for stocks to become affected by any minor disease which may be responsible for later deterioration of the variety. It is under such conditions that the standard methods for analysis of variance are applied and the improved performance of the new cane measured in terms of significance.

TABLE 1.

COMPARISON IN YIELDS BETWEEN NEW AND OLD VARIETIES.

No. and Crop.	New Variety.	Old Variety.	Difference (new—old).
NAMBOUR			
	C.P. 29/116	Co. 290	
R. 34	30·13	24·67	5·45 ± 1·00†
	C.P.29/116	P.O.J.2878	
R. 20	32·79	26·16	6·63 ± 1·41 †
	Q.47	P.O.J.2878	
R. 7	34·76	25·63	9·14 ± 2·40 †
MACKAY			
	Q.50	E.K.28	
P. 11	38·14	29·05	9·09 ± 1·41 †
	Q.50	P.O.J.2878	
P. 17	35·62	30·85	4·76 ± 1·29 †
R. 11	28·36	21·64	6·73 ± 1·39 †
	Q.50	P.O.J.2725	
P. 9	41·17	33·89	7·28 ± 1·27 †
	Q.50	M.1900	
P. 9	34·00	24·00	10·00 ± ·90 †
R. 7	23·93	10·64	13·29 ± 2·59 †
	Q.50	Co.290	
P. 7	34·43	28·29	6·14 ± 1·78 †
	Q.28	M.1900	
P. 8	29·25	22·38	6·88 ± 1·06 †
R. 7	19·00	10·64	8·36 ± 2·30 †
	Q.28	EK.28	
P. 7	31·00	27·93	3·07 ± 1·79
	Q.28	P.O.J.2878	
P. 7	27·71	27·86	–·14 ± 1·44
R. 10	21·90	21·80	·10 ± 1·49

TABLE 1—*continued.*

COMPARISON IN YIELDS BETWEEN NEW AND OLD VARIETIES—*continued.*

No. of Crop.	New Variety.	Old Variety.	Difference (new—old).
BUNDABERG			
	C.P.29/116	P.O.J.2878	
P. 12	43·50	36·92	6·58 ± 2·56 *
1 R. 12	29·87	25·51	4·36 ± 2·62
	Q.49	P.O.J.2878	
1 R. 15	31·33	28·25	3·09 ± 1·41 *
MULGRAVE			
	Trojan	Badila	
1 R. 9	30·80	26·80	4·00 ± 2·84 Actual
BABINDA			
P. 19	28·74	26·07	2·66 ± 2·16 Actual
P. 26	28·43	25·71	2·72 ± 1·09* Estimated
1 R. 19	30·13	28·05	2·08 ± 1·82 Actual
1 R. 25	28·00	26·58	1·42 ± 1·08 Estimated
2 R. 7	25·57	20·29	5·29 ± 1·74* Estimated
	Trojan	H.Q.426	
1 R. 9	25·30	22·59	2·71 ± 3·96 Actual
1 R. 12	28·42	24·26	4·15 ± 1·67* Estimated
	Q.44	Badila	
1 R. 10	26·40	26·00	·40 ± 1·89 Estimated
2 R. 8	28·58	26·21	2·36 ± 5·17 Actual
2 R. 14	22·00	22·43	–·43 ± 1·62 Estimated

* = significantly different from zero at 5 per cent. level.
† = significantly different from zero at 1 per cent. level.

When such a new cane becomes commercialized, it is grown on a wider variety of soil types, on marginal lands and under conditions which vary from some or all of the trial sites. Cane breeding and selection has become so specialized that alteration in micro-environment is, in many cases, sufficient to result in a differential response between varieties. It is not to be anticipated, therefore, that varietal trial figures will be repeated to the same extent in large scale plantings.

At the same time the large-scale development of a new cane, brought about by vegetative reproduction from a small stock of plants, allows time for ingress of minor disease organisms. If the variety is susceptible to such attack then the first stage of deterioration has already commenced.

An attempt was made in 1949 to assess the part played by new varieties in Queensland, since in all districts a varietal change of some magnitude was taking place. Since cane growing in this State is not, in the main, carried out on plantation lines, but on a small farm system, production statistics pertaining to separate blocks are not available. The method used, therefore, was to collect figures of production from the 1949 crop in which could be compared the yields of new and old varieties of similar age and class on the same soil type on a large number of different farms. By this means, groups of figures were obtained in which a certain two varieties were compared and an alaysis made to ascertain the extent and significance of the differences. These figures are shown in Table 1.

It will be seen from these figures that in the Nambour area C.P.29/116 was significantly better at the one per cent. level than Co.290 and P.O.J.2878 and that Q.47 displayed a similar superiority over P.O.J. 2878. These figures are in line with those obtained from field varietal trials. At Bundaberg, the differences between C.P.29/116 and Q.49 on the one hand and C.P.29/116 and P.O.J.2878 on the other were not so marked.

The Mackay district figures demonstrated in no uncertain manner the undoubted superiority of Q.50 over E.K.28, P.O.J.2878, P.O.J.2725, M.1900 S and Co.290 which is again in line with varietal trial results. The failure of Q.28 to outyield E.K.28 and P.O.J.2878 convincingly may have been due in some cases to the former variety being affected by the Q.28 ratoon stunting disease.

In the northern areas of Mulgrave and Babinda most of the comparisons were made between Trojan and Badila and few of these showed that Trojan was significantly better than the old standard. This is not a reversal of varietal trial results since these two varieties were not included in the same trials in these areas as it was considered that they were not suited to the same soil conditions.

It may be claimed from the above figures, representing, as they do, experiences on 368 farms, that new varieties have on the whole shown a parallel degree of significantly increased tonnage as was experienced in the prior varietal trials. At the same time a measure has been obtained of the increased value these canes confer upon the production of a district. There is nothing to suggest at this early stage that any of these new productions is deteriorating even though C.P.29/116 has been a major variety in South Queensland since 1945. The exception is Q.28 in Mackay, which variety within two years of commercialization exhibited unmistakable signs of deterioration. This, as shown above, was due to a previously unknown and unidentified disease. It is feasible that the same organism has contributed to senescence of other varieties in the past but that the tolerance of those varieties has tended to mask the stunting and that the effect has been observed as a gradual diminution of vigour and interpreted as a loss of vigour.

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[1] BELL, A. F. 1935. Sick soils. Proc. 6th Conf. Qld. Soc. Sug. Cane Tech. 978.

[2] STEINDL, D. R. L. 1950. Ratoon stunting disease. Proc. 7th Cong. I.S.S.C.T.

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